

Air-Shower Spectroscopy at horizons

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Abstract

Downward cosmic rays are mostly revealed on the ground by their air-showers diluted and filtered secondary $\mu^+\mu^-$ traces and-or by their (Cerenkov - Fluorescent) lights because of the high altitude numerous and luminous electromagnetic e^+e^-, γ shower component. Horizontal and Upward air-showers are even more suppressed by deeper atmosphere opacity and by the Earth shadows. In such noise-free horizontal and upward directions rare Ultra High Cosmic rays and rarer neutrino induced air-showers may shine, mostly mediated by resonant PeVs $\bar{\nu}_e + e^- \rightarrow W^-$ interactions in air or by higher energy Tau Air-showers originated by ν_τ skimming the Earth. At high altitude (mountains, planes, balloons) the air density is so rarefied that nearly all common air-showers might be observed at their maximal growth at a tuned altitude and directions. The arrival angle samples different distances and the corresponding most probable primary cosmic ray energy. The larger and larger distances (between observer and C.R. interaction) make wider and wider the shower area and it enlarge the probability to be observed (up to three order of magnitude more than vertical showers); the observation of a maximal electromagnetic shower development may amplify the signal by two-three order of magnitude (respect suppressed shower at sea level); the peculiar altitude-angle range (ten-twenty km. height and $\simeq 80^\circ - 90^\circ$ zenith angle) may disentangle at best the primary cosmic ray energy and composition. Even from existing mountain observatory the up-going air-showers may trace , above the horizons, PeV-EeV high energy cosmic rays and , *below* the horizons, PeV-EeV neutrino astronomy: their early signals may be captured in already existing gamma telescopes as Magic at Canarie, while facing the Earth edges during (useless) cloudy nights.

1 Introduction

Ultra High Energy Cosmic Rays (UHECR) Showers (from PeVs up to EeVs and above, mainly of hadronic nature) born at the high altitude in the atmosphere, may blaze (from the far edge) *above the horizon* toward Telescopes such as Magic one. The earliest gamma and Cerenkov lights produced while they propagate through the atmosphere are partially absorbed because of the deep horizontal atmosphere column depth ($\simeq 10^4$ up to $5 \cdot 10^4 \text{ g} \cdot \text{cm}^{-2}$), must anyway survive and also revive: indeed additional diluted but penetrating muon bundles (from the same by C.R. shower) are decaying not far from the Telescope into electrons which are source themselves of small air-showers and Cerenkov lights . Direct muons hitting the Telescope may blaze a ring or an arc of lights. These muon bundle secondaries, about 10^{-3} times less abundant than the peak of the gamma shower photons are arising at high altitude, at an horizontal distances 100–500 km far from the observer (for a zenith angle $85^\circ - 91.5^\circ$

while at 2.2km. height); therefore their hard (tens-hundred GeV) muon shower bundles (from ten to millions muons at TeVs-EeVs C.R. energy primary) might spread in huge areas (up to tens- hundred km^2); they are marginally bent by geo-magnetic fields and they are randomly scattered, often decaying at hundred-tens GeV energies, into electrons pairs; their consequent mini electromagnetic-showers are traced by their optical Cerenkov flashes. These diluted (but spread and therefore better detectable) brief (nanosecond-microsecond) optical signals may be captured as a light cluster by largest telescope on ground as recent Stereoscopic Magic, Hess, Veritas arrays. Cerenkov flashes, single or clustered, must take place, at detection threshold, at least at a rate of hundreds events a night for Magic-like Telescope facing horizons at zenith angle $85^\circ \leq \theta \leq 90^\circ$. Their "guaranteed" discover may offer a new gauge in CR and UHECR detection. Their primary hadronic signature might be partially hidden by the deep column depth distance, leading to few narrow clustered and (possibly) slitted (by geomagnetic field) dots; however sometime there is an additional and conclusive trace offered by the same air-shower secondary muon-electron Cerenkov flashes in flight blazing the telescope. On the same time and with the similar behaviour *below the horizons* a more rare (three-four order of magnitude) but even more exciting PeV-EeVs Neutrino ν_τ Astronomy may arise by the Earth-Skimming Horizontal Tau Air-Showers (HorTaus and Uptaus) [6]; these UHE Taus are produced inside the Earth Crust by the primary UHE incoming neutrino ν_τ , $\bar{\nu}_\tau$, neutrinos generated mainly by their muon-tau neutrino oscillations from galactic or cosmic sources,[6],[7],[8]. Above or below the horizon edge, within a few hundred of km distances, horizontal showers could reveal the guaranteed tuned $\bar{\nu}_e-e \rightarrow W^- \rightarrow X$ air-showers at 6.3PeV Glashow resonant peak energy; the W^- main hadronic (2/3) or leptonic and electromagnetic (1/3) signatures may be well observed (within tens-hundred km distance) and their rate might calibrate a new horizontal neutrino-multi-flavour Astronomy [6]. The $\bar{\nu}_e-e \rightarrow W^- \rightarrow X$ of nearby nature (respect to most far away ones at same zenith angle of hadronic nature) would be better revealed by a Stereoscopic Magic twin telescope or a Telescope array like Hess, Veritas. Additional Horizontal flashes might arise by Cosmic UHE $\chi_o + e \rightarrow \tilde{e} \rightarrow \chi_o + e$ electromagnetic showers within most SUSY models, if UHECR are born in topological defect decay or in their annihilation, ejecting a relevant component of SUSY particles. The UHE $\chi_o + e \rightarrow \tilde{e} \rightarrow \chi_o + e$ behaves (for light \tilde{e} masses around Z boson ones) as the Glashow resonant case [1]. Finally similar signals might be abundantly and better observed if UHE neutrinos share new extra-dimension (TeV gravity) interactions: in this case also neutrino-nucleons interaction may be an abundant source of PeVs-EeVs Horizontal Showers originated in Air [6]. The total amount of air inspected within the solid angle $2^\circ \cdot 2^\circ$ by MAGIC height at Horizons (360 km.) exceed $4km^3$ but their consequent detectable beamed volume are corresponding to an isotropic narrower volume: $V = 1.36 \cdot 10^{-2} km^3$, nevertheless comparable (for Pevs $\bar{\nu}_e-e \rightarrow W^- \rightarrow X$ and EeVs ν_τ , $\bar{\nu}_\tau + N \rightarrow \tau \rightarrow$ showers) to the present AMANDA confident volume. Moreover monitoring a defined source (like Crab,AGN,BL Lac, GRBs, SGRs, possibly a micro-quasar jet and SNRs) at its dawn or rise, the horizontal interposed conical air volume $V_{air} \simeq 1000km^3$ exceed the km^3 water mass, making such Horizontal Showering Astronomy (by Magic-like telescopes) already the most sensitive Neutrino detector. Moreover while looking at the Earth edges the Neutrino Magic Telescope monitor a wider and denser earth crust volume comparable to nearly $75 km^3$ w.e. mass (at EeV energy) and twice less at few hundred PeVs, making it the most effective high energy neutrino telescope available at the moment.

2 Blazing Cerenkov Flashes by Showers and decaying Muons

The ultrahigh energy cosmic rays (UHECR) have been studied in the past mainly versus their secondaries (γ , e^\pm , μ^\pm) collected vertically in large array detectors on the ground. This is due to the rare event rate of the UHECR in the atmosphere and due to the high altitude where the shower takes place, expand and amplify downward. On the contrary at the horizons the UHECR are hardly observable (but

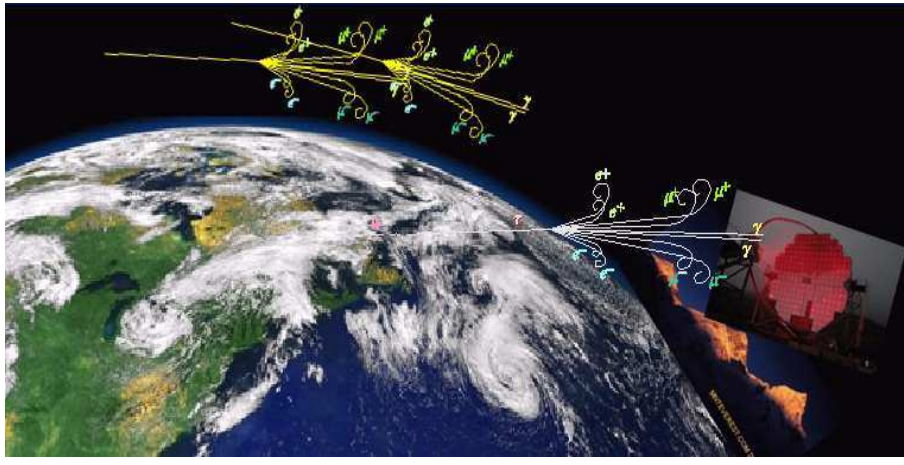


Figure 1: Schematic Picture of an Horizontal Cosmic Ray Air-Shower (superior track) (HAS), and an up-going Tau Air-Shower induced by EeV Earth-Skimming $\bar{\nu}_\tau, \nu_\tau$ HORTAU and their muons and Cerenkov lights blazing a Telescope as the Magic one. Also UHE $\bar{\nu}_e - e$ and $\chi^0 - e$ Scattering in terrestrial horizontal atmosphere at tens PeVs energy may simulate HAS, but mostly at nearer distances respect largest EeV ones of hadron nature at horizon's edges. See [5],[6], [2],[10],[7],[8],

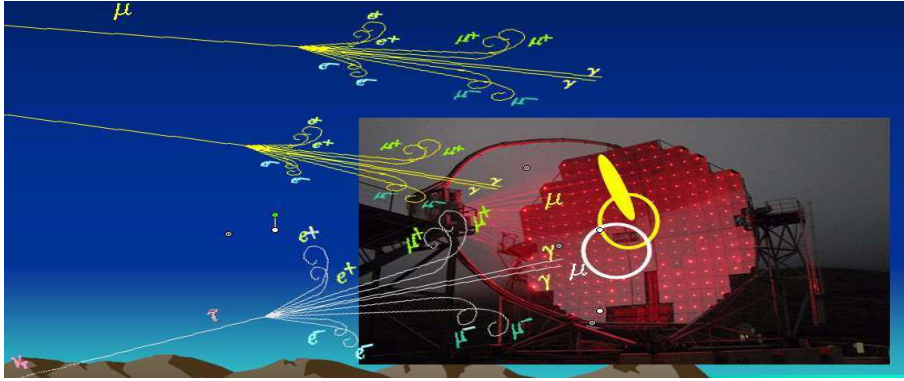


Figure 2: Schematic Picture as above for direct muon Cerenkov rings and a lateral gamma-electron showers induced by secondary muon decay in flight



Figure 3: Schematic Picture of an Horizontal Cosmic Ray Air-Shower (induced by UHE $\bar{\nu}_e - e$ (at resonant energy 6.3 PeV) and $\chi^0 - e$ scattering in terrestrial horizontal atmosphere at tens PeVs energy. The distances and consequent volumes within the view cone exceed the 10^3 km^3 air volume and a mass comparable with a km^3 water or ice mass. Therefore MAGIC , while pointing a GRB,SGR or BL Lac Burst at Horizons ((3%) of the GRB-SGRs events) behave now as a km^3 neutrino telescope at PeVs energy.

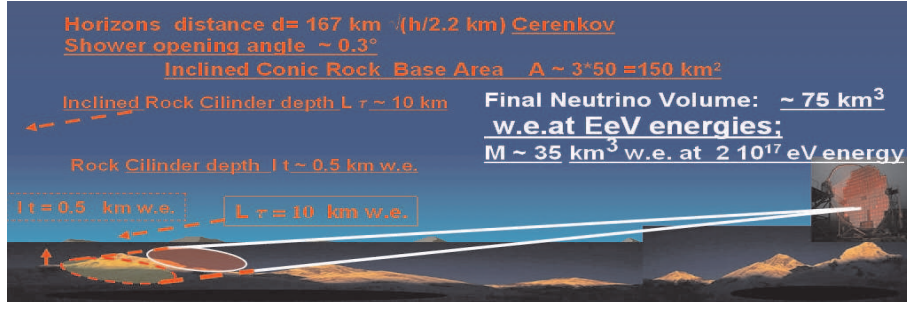


Figure 4: Schematic Picture of an Upward Horizontal Cosmic Ray Air-Shower (induced by UHE $\nu_\tau - N, \bar{\nu}_\tau - N$ interactions (at hundreds PeV energies) in terrestrial earth crust. MAGIC , while pointing a GRB, a SGR or an active AGN at Horizons terrestrial edges ((1%) of the GRB-SGRs events) behave as a huge $\simeq 100\text{km}^3$ neutrino telescope, in *that* direction. See [5],[6], [2],[10],[7],[8],

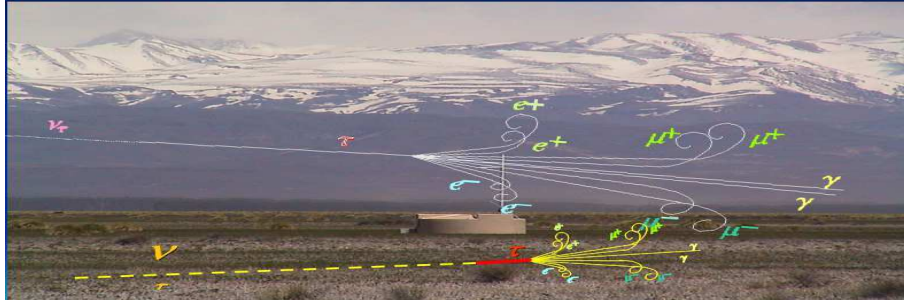


Figure 5: Schematic Picture of an Horizontal Cosmic Ray Air-Shower (superior track) (HAS), induced by EeV $\bar{\nu}_\tau, \nu_\tau$ HORTAU born inside the east side of the Ande at west side of Auger array detector. Our prediction is that within the first year of record AUGER detectors *must* reveal the Ande shadows to UHECR, from West-North side by their statistical absence respect flat opposite directions, while within three-five years it *should* probably observe a few of HORTAUs induced by GZK neutrinos interacting inside the same shadows of the Ande mountain chain (see [6],[7],[8]); [16]) ;

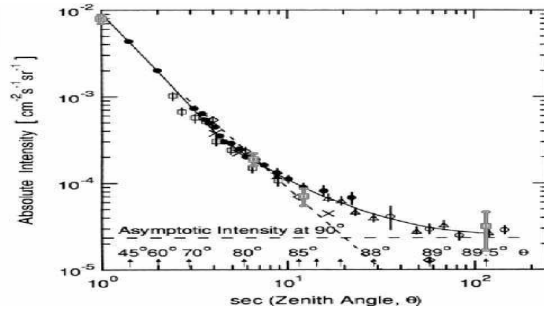


Figure 6: Observed Flux of Muons as a function of the zenith angle above (see also [12] and [13]) the horizons; for the muons below the horizons their flux at 91° zenith angle is two order of magnitude below $\simeq 10^{-7}\text{cm}^{-2}\text{s}^{-1}\text{sr}^{-1}$, as observed by NEVOD and Decor detectors in recent years. As the zenith angle increases the upward muons flux reduces further ; at 94° and ten GeV energy it is just four order below: $\simeq 10^{-9}\text{cm}^{-2}\text{s}^{-1}\text{sr}^{-1}$, see recent results by NEVOD and DECOR experiments (2003) ; at higher energies (hundred GeVs) and larger zenith angle only muons induced by atmospheric neutrinos arises at $\simeq 2 - 3 \cdot 10^{-13}\text{cm}^{-2}\text{s}^{-1}\text{sr}^{-1}$ as well as Neutrino Tau induced Air-Shower (muon secondaries)

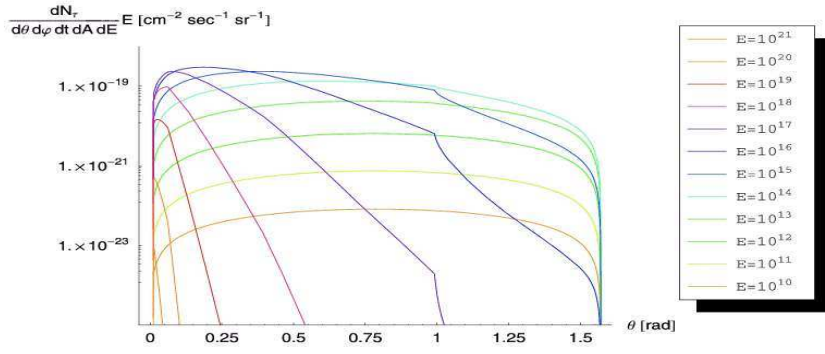


Figure 7: Tau Air-Showers rates angular distribution, by Earth Skimming Neutrino τ inside the rock, assuming a rock surface density; the UHE E_{ν_τ} energies are shown in eV unity. The incoming neutrino flux is a minimal GZK flux (for combined ν_τ and $\bar{\nu}_\tau$) at $\phi_{\nu_\tau} \cdot E_{\nu_\tau} \simeq 50 \text{ eV cm}^{-2} \text{ s}^{-1} \text{ sr}^{-1}$. See [8],[9]

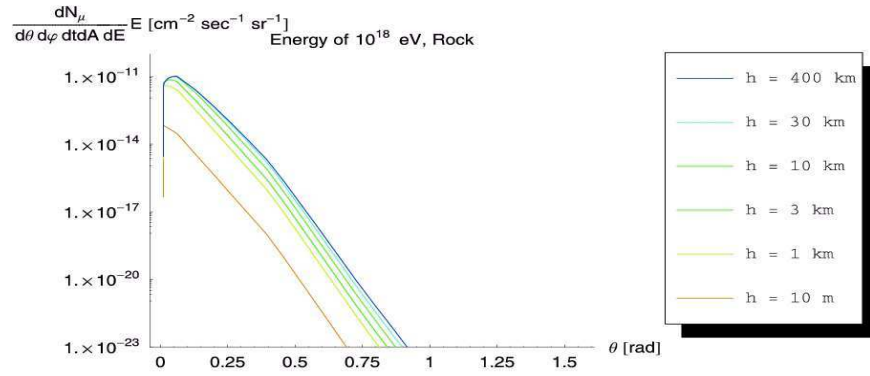


Figure 8: Consequent Muons Secondary (by Tau Air-Showers) rate angular distribution at different observer quota height (see label), at 10^{18} eV energy, exceeding (at horizontal zenith angle $\theta \simeq 93 - 97^\circ$) even the same atmospheric neutrino induced up-going muon flux $\phi_\mu \simeq 3 \cdot 10^{-13} \cdot \text{cm}^{-2} \text{ s}^{-1} \text{ sr}^{-1}$. The incoming neutrino flux is a minimal GZK flux (for combined ν_τ and $\bar{\nu}_\tau$) at $\phi_{\nu_\tau} \cdot E_{\nu_\tau} \simeq 50 \text{ eV cm}^{-2} \text{ s}^{-1} \text{ sr}^{-1}$; see [9],[8],



Figure 9: An ideal Array of Crown-Telescopes at Magic site, able to trace the horizontal showers at different angle of view, few km distance; these elements may test the contemporaneous shower profile and they might cooperate with similar scintillator (Crown detectors not shown in figure, [13] and Fargion et al, ApJ. 2004) able to better trigger and reveal the electromagnetic and the muon content of the showers.

also rarely looked for). They are diluted both by the larger distances as well as by the exponential atmosphere opacity suppressing the electromagnetic (electron pairs and gamma) secondaries; also their rich optical Cerenkov signal is partially suppressed by the horizontal air opacity. However this suppression acts also as an useful filter leading to the higher CR events; their Cerenkov lights will be scatter and partially transmitted (around 90° zenith angle by a factor $1.8 \cdot 10^{-2}$ at 551 nm., $6.6 \cdot 10^{-4}$ at 445 nm.) depending on the exact zenith angle and seeing: assuming on average a suppression $5 \cdot 10^{-3}$ and the nominal Magic energy threshold at 30 GeV, it does corresponds to a hadronic shower at far horizons (diluted by nearly three order of magnitude by larger distances) at energy above $E_{CR} \simeq 6$ PeV. Their primary flux may be estimated considering the known cosmic ray on the top of the atmosphere (both protons or helium) (see DICE Experiment referred in[12]) : $\phi_{CR}(E_{CR} = 6 \cdot 10^{15} eV) \simeq 9 \cdot 10^{-12} cm^{-2} s^{-1}$. Within a Shower Cerenkov angle $\Delta\theta = 1^\circ$ at a distance $d = 167 km \cdot \sqrt{\frac{h}{2.2 km}}$ (zenith angle $\theta \simeq 87^\circ - 88^\circ$) the shower surface corresponds to a wide area : $[A = \pi \cdot (\Delta\theta \cdot d)^2 \simeq 2.7 \cdot 10^{11} cm^2 (\frac{d}{167 km})^2]$, observed within an opening angle $[\Delta\Omega = (2^\circ \cdot 2^\circ)\pi \simeq 3.82 \cdot 10^{-3} sr.]$; the consequent event rate time a night of record ($[\Delta(t) = 4.32 \cdot 10^4 s]$) by Magic is

$$N_{ev} = \phi_{CR}(E = 6 \cdot 10^{15} eV) \cdot A \cdot \Delta\Omega \cdot \Delta(t) \simeq 401/12h$$

. Therefore one may foresee nearly every two minutes a far hadronic Cerenkov lightening Shower in Magic facing at the far horizons at zenith angle $87^\circ - 88^\circ$. Increasing the observer altitude h , the allowable horizon zenith angle also grows: $\theta \simeq [90^\circ + 1.5^\circ \sqrt{\frac{h}{2.2 km}}]$ In analogy at a more distant horizontal edges (standing at height $2.2 km$ as for Magic, while observing at zenith angle $\theta \simeq 89^\circ - 91^\circ$ still above the horizons) the observation range d increases : $d = 167 \sqrt{\frac{h}{2.2 km}} + 360 km = 527 km$; the consequent shower area widen by more than an order of magnitude (and more than three order respect to vertical showers) and the consequent foreseen event number, now for a much harder penetrating C.R. shower at $E_{CR} \geq 3 \cdot 10^{17} eV$, becomes:

$$N_{ev} = \phi_{CR}(E = 3 \cdot 10^{17} eV) \cdot A \cdot \Delta\Omega \cdot \Delta(t) \simeq 1.6/12h$$

Therefore at the far edges of the horizons $\theta \simeq 91.5^\circ$, once a night, an UHECR around EeV energies, may blaze to the Magic (or Hess, Veritas, telescope arrays). At each of these far primary Cherenkov flash is associated a long tail of secondary muons in a very huge area; these muons eventually are also hitting inside the Telescope disk; their nearby showering in air, while decaying into electrons in flight, (source of electromagnetic mini-gamma showers of tens-hundred GeVs energy) is also detectable at a rate discussed below.

3 Muon signals: Arcs, Rings and γ Showers by $\mu^\pm \rightarrow e^\pm$

As already noted the main shower blazing photons from a CR may be also regenerated or aided by its secondary tens-hundred GeVs muons, either decaying in flight as a gamma flashes, or directly painting Cerenkov arcs or rings while hitting the telescope. Indeed these secondary penetrating muon bundles may reach hundreds km distances ($\simeq 600 km \cdot \frac{E_\mu}{100 GeV}$) far away from the shower origin. To be more precise a part of the muon primary energy will dissipate along 360 km air-flight (nearly a hundred GeV energy), but a primary 130 – 150 GeV muon will survive at final $E_\mu \simeq 30 - 50$ GeV energy, at minimal Magic threshold value. Let us remind the characteristic secondary abundance in a shower: $N_\mu \simeq 3 \cdot 10^5 \left(\frac{E_{CR}}{PeV}\right)^{0.85}$. These secondaries are mostly at a minimal (GeV) energies [4]; for the harder (a hundred GeV) muons their number is (almost inversely proportionally to energy) reduced: $N_\mu(10^2 \cdot GeV) \simeq 1.3 \cdot 10^4 \left(\frac{E_{CR}}{6 PeV}\right)^{0.85}$. These values must be compared with the larger peak multiplicity (but much lower energy) of electro-magnetic shower nature: $N_{e^+e^-} \simeq 2 \cdot 10^7 \left(\frac{E_{CR}}{PeV}\right)$; $N_\gamma \simeq 10^8 \left(\frac{E_{CR}}{PeV}\right)$. As

mentioned most of these electromagnetic tail is lost (exponentially) at horizons (above slant depth of a few hundreds of $\frac{g}{cm^2}$)(out of the case of re-born, upgoing τ air-showers [8],[9]); therefore gamma-electron pairs are only partially regenerated by the penetrating muon decay in flight, $\mu^\pm \rightarrow \gamma, e^\pm$ as a parasite electromagnetic showering [3]. Indeed μ^\pm may decay in flight (let say at 100 GeV energy, at 2 – 3% level within a 12 – 18 km distances) and they may inject more and more lights, to their primary (far born) shower beam.

These tens-hundred GeVs horizontal muons and their associated mini-Cerenkov γ Showers have two main origin: (1) either a single muon mostly produced at hundreds km distance by a single (hundreds GeV-TeV parental) C.R. hadron : this is a very dominant component; (2) a shower by rarer muon, part of a wider and spread horizontal muon bundle of large multiplicity born at TeVs-PeV or higher energies. A whole continuous spectrum of multiplicity begins from an unique muon up to a multi muon shower production. The dominant noisy "single" muons at hundred-GeV energies will loose memory of the primary low energy and hidden mini-shower, (a hundreds GeV or TeVs hadrons); a single muon will blaze just alone. The muon "single" rings or arcs frequency is larger (than muon bundles ones) and it is based on solid observational data ([13] ; [12], as shown in fig.2 and references on MUTRON experiment therein); these "noise" event number is:

$$N_{ev} = \phi_\mu(E \simeq 10^2 eV) \cdot A_{Magic} \cdot \Delta\Omega \cdot \Delta(t) \simeq 120/12h$$

The additional gamma mini-showers around the telescope due to a decay (at a probability $p \simeq 0.02$) of those muons in flight, recorded within a larger collecting Area $A_\gamma \geq 10^9 cm^2$ is even a more frequent (by a factor ≥ 8) noisy signal:

$$N_{ev} \geq \phi_\mu(E \simeq 10^2 eV) \cdot p \cdot A_\gamma \cdot \Delta\Omega \cdot \Delta(t) \simeq 960/12h$$

. These single background gamma-showers must take place nearly once a minute (in an silent hadronic background) and they are an useful tool to be used as a meter of the Horizontal C.R. verification.

On the contrary PeVs (or higher energy) CR shower Cerenkov lights may be observed, more rarely, in coincidence both by their primary and by their later secondary arc and gamma mini-shower. Their 30 – 100 GeV energetic muons are flying nearly undeflected $\Delta\theta \leq 1.6^\circ \cdot \frac{100 \cdot GeV}{E_\mu} \frac{d}{300km}$ for a characteristic horizons distances d , partially bent by geo-magnetic 0.3 Gauss fields; as mentioned, to flight through the whole horizontal air column depth (360 km equivalent to 360 water depth) the muon lose nearly 100 GeV; consequently the origination muon energy should be a little above this threshold to be observed by Magic: (at least 130 – 150 GeV along most of the flights). The deflection angle is therefore a small one: ($\Delta\theta \leq 1^\circ \cdot \frac{150 \cdot GeV}{E_\mu} \frac{d}{300km}$). Magic telescope area ($A = 2.5 \cdot 10^6 cm^2$) may record at first approximation the following event number of direct muon hitting the Telescope, flashing as rings and arcs, each night:

$$N_{ev} = \phi_{CR}(E = 6 \cdot 10^{15} eV) \cdot N_\mu(10^2 \cdot GeV) \cdot A_{Magic} \cdot \Delta\Omega \cdot \Delta(t) \simeq 45/12h$$

to be correlated (at 11% probability) with the above results of 401 primary Cerenkov flashes at the far distances. As already mentioned before, in addition the same muons are decaying in flight at a minimal probability 2% leading to a mini-gamma-shower event number in a quite wider area ($A_\gamma = 10^9 cm^2$):

$$N_{ev} = \phi_{CR}(E = 6 \cdot 10^{15} eV) \cdot N_\mu(10^2 \cdot GeV) \cdot p \cdot A_\gamma \cdot \Delta\Omega \cdot \Delta(t) \simeq 360/12h$$

Therefore, in conclusion, at $87^\circ - 88^\circ$ zenith angle, there are a flow of primary $E_{C.R} \simeq 6 \cdot 10^{16} eV$ C.R. whose earliest showers and consequent secondary muon-arcs as well as nearby muon-electron mini-shower take place at comparable (one every 120 s.) rate. These *certain* clustered signals offer an unique tool for immediate gauging and calibrating of Magic (as well as Hess, Cangaroo, Veritas Cerenkov Telescope Arrays) for Horizontal High Energy Cosmic Ray Showers. Some more rare event may contain at once both Rings, Arcs and tail of gamma shower and Cerenkov of far primary shower. It is possible to estimate

also the observable muons-electron-Cerenkov photons from up-going Albedo muons observed by recent ground experiments [17] [18]: their flux is already suppressed at zenith angle 91° by at least two order of magnitude and by four order for up-going zenith angles 94° . Pairs or bundles are nevertheless even more rare (up to $\phi_\mu \leq 3 \cdot 10^{-13} \text{cm}^{-2} \text{s}^{-1} \text{sr}^{-1}$ [17] [18]). They are never associated to up-going shower out of the case of tau or by nearby Glashow $\bar{\nu}_e - e \rightarrow W^-$ air-showers and comparable $\chi^0 + e \rightarrow \tilde{e}$ detectable by stereoscopic Magic or Hess array telescopes, selecting and evaluating their column depth origination, just discussed below.

4 Conclusions: UHECR versus Neutrino air-showers

The appearance of horizontal UHE $\bar{\nu}_\tau \nu_\tau \rightarrow \tau$ air-showers (Hortaus or Earth-Skimming neutrinos) has been widely studied [5],[6], [2],[10],[7],[8],[14], [19],[15],[9]; their rise from the Earth is source of rare clear signals for neutrino UHE astronomy (see fig.3 and fig.4). However also horizontal events by UHE 6.3 PeV, Glashow $\bar{\nu}_e - e \rightarrow W^-$ and a possible comparable SUSY $\chi^0 + e \rightarrow \tilde{e}$ [1] hitting and showering in air have non negligible event number:

$$N_{ev} = \phi_{\bar{\nu}_e}(E = 6 \cdot 10^{15} \text{eV}) \cdot A \cdot \Delta\Omega \cdot \Delta(t) \simeq 5.2 \cdot 10^{-4} / 12h$$

assuming the minimal GZK neutrino flux : $\phi_{\bar{\nu}_e}(E = 6 \cdot 10^{15} \text{eV}) \simeq 5 \cdot 10^{-15} \text{eV cm}^{-2} \text{s}^{-1} \text{sr}^{-1}$; the energy flux is $\phi_{\bar{\nu}_e} \cdot E_{\bar{\nu}_e} \simeq 30 \text{eV cm}^{-2} \text{s}^{-1} \text{sr}^{-1}$. (We assume an observing distance at the horizons $d = 167 \text{km} \cdot \sqrt{\frac{h}{2.2 \text{km}}}$.) Therefore during a year of night records and such a minimal GZK flux, a crown array of a 90 Magic-like telescopes on $2 \cdot \pi = 360^\circ$ circle facing the horizons, would discover an event number comparable to a Km^3 detector, (nearly a dozen events a year). In conclusion while Magic looking up see down-ward γ tens GeVs Astronomy, Magic facing the Horizons may well see far UHE (PeVs-EeVs) CR, and rarely, along the edge, GZK $\bar{\nu}_e - e \rightarrow W^-$ neutrinos showering in air, as well as charged current $\nu_\tau + N \rightarrow \tau^-$, $\bar{\nu}_\tau + N \rightarrow \tau^+$ whose decay in flight while in air leads to Hortau air-showers. Even SUSY $\chi^0 + e \rightarrow \tilde{e} \rightarrow \chi^0 + e$ lights in the sky (with showers) may blaze on the far frontier of the Earth. Tau Air Showers by GZK neutrinos from Earth are observable by EUSO and OWL within hundreds of Horizontal UHECR. EeV Tau and Glashow showers in present Magic Upward Horizons might be present during GRB or SGR or AGN activities. Already MAGIC looking at Earth edge is comparable to AMANDA at PeVs energies. Contrary to spherical symmetric showers in water and ice-cube, or blurred radio showers from ice and salt (ANITA-like experiments), such neutrino induced air-showers are well collimated toward their source, offering a first view of yet undiscovered Neutrino Astronomy.

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